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Making sense of policy implementation: The construction and uses of expertise and evidence in managing freshwater environments

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Abstract

This paper explores how environmental policy is implemented and enacted through the management of technical and institutional knowledge at the local level. We use the conservation of the freshwater pearl mussel in the River Esk, North Yorkshire, UK, as an empirical case study to examine the interaction that takes place between professionals from different institutional and disciplinary backgrounds as they come together to work on a common problem. We focus on two aspects: the way in which an institutional context was created; and the interaction between the professionals involved. Our analysis demonstrates that the strategic intermediary role of professionals is vital to policy implementation. The intermediary uses their strategic vision and undertakes political manoeuvring following the presentation and interaction of different knowledges and evidence to ensure a certain course of action. This is different from a knowledge broker. The role of the professional is to draw on expertise, both formal and tacit, to interpret and judge data in relation to decision making. Those individuals participating in decision making of this nature have multiple histories, roles and motivations which enables innovation in the creation of meaning within environmental management. The quality of the evidence can be assumed adequate once subject to diverse professional scrutiny. These findings are important since innovative behaviour that creates new structures and practices is becoming central to delivering good management of land, water and biodiversity.

1. Introduction

In his analysis of policy making [Hajer \(2003\)](#) focuses on the ‘institutional void’ that arises between the nature of environmental solutions and the extent of the political sphere necessary for their design. He argues that in deliberating policy there is a simultaneous activity at play which involves the negotiation of new institutional rules, that is, the making and implementing of new rules at the same time. He refers to this as the ‘double dynamic’. In this paper we build on Hajer’s work by exploring the ‘institutional void’ that lies in the space between policy and practice in the field; rather than being concerned with policy making in complex environmental systems we focus on implementation.

Environmental management is one area of policy implementation that is both complex and dynamic requiring the engagement of a range of practitioners with overlapping and multiple objectives ([Fish et al., 2010](#)). A body of work has looked at the engagement of a range of different stakeholders in the decision making process concerned with the development and the implementation of environmental plans and practices ([Callon, 1999](#); [Nowotny et al., 2001](#); [Eden et al., 2006](#); [Collins and Weinel, 2011](#)). In the area of land and water management [Juntti and Potter \(2002\)](#), [Medd and Marvin \(2008\)](#), [Nutley et al. \(2003\)](#) and [Proctor et al. \(in press\)](#) have focussed on practices of implementation. We argue that this space of deliberation and practice represents an institutional void in that new rules and norms must evolve in order to design robust solutions to complex environmental problems.

We situate our study in the broad context of Interpretative Policy Analysis (IPA); an analytic tool that recognizes that there are at least three potential groups interpreting any policy: the policymakers themselves, those responsible for implementing the policy, and those affected directly by the policy (Yanow, 1996). As Wesselink et al. (2012) point out in the introduction to this Special Issue, IPA is about the how of policy, about how meaning is achieved and enacted within and between these groups. The implications of the IPA approach are reflected in Yanow's call for both the need for greater reflexivity and positionality within the practices of environmental management, and for more ethnographic research to explore how meanings are made and communicated in practice (Yanow, 2000; Yanow and Tsoukas, 2009). We respond to this call and evaluate how environmental managers have implemented EU and National legislation to 'get something done' at the local level to improve biodiversity of riverine habitats in North Yorkshire, UK. We do this through the analysis of a case study: conservation of the freshwater pearl mussel in the River Esk, North Yorkshire. This case study is typical of many of the day-to-day decisions facing environmental managers: it involves a range of professional actors and local land owners; it is a high profile problem that brings together issues of water quality, biodiversity and land use, and is driven by EU legislation. We focus on two aspects: the first is the way in which an institutional context was created to bring together the resources and people relevant to achieving the objective; the second is the interaction between the various professionals involved and the expertise that they called upon to produce, use and interpret evidence.

In this way our paper explores the construction and legitimation of knowledge, the pivotal role of individuals for creating ad hoc institutions, and the processes of drawing upon evidence for decision making. In Section 2 we briefly review some of the different approaches to the production, transfer and application of knowledges in environmental management. Section 3 introduces the case study that we use to illustrate our analysis and in Section 4 we go on to examine in more detail the bringing together of the committee – to fill the perceived institutional void – and its strategic alignment. Section 5 illustrates the ways in which meanings are made through an in-depth study of the reflexivity and positionality of the actors concerned with identifying the number of pearl mussels in the river and the reason for the decline of the species. In Section 6 we locate the analysis within the IPA framework.

2. Professional engagement and the enrolment of evidence

There is an increasing expectation that policy makers should be using the best available evidence from research when making decisions (Campbell et al., 2011). This is coupled with an understanding that there are many equally legitimate sources of knowledge and evidence that need to be drawn upon to inform management of environmental problems (Wynne, 2003; Petts, 2007; Lidskog, 2008; Collins and Weinel, 2011). Evidence, ideas, arguments and framing all matter in the governance of environmental problems (Jasanoff, 2003; Owens, 2010). By exploring the institutional void that lies in the space between policy and practice we are integrating a number of key research themes. These are the role of expertise, the nature of the evidence used to support these decisions and the role of key individuals in making and implementing decisions.

The academic debate on expertise is centred on the boundaries that exist between experts and the public and whether these can or should be dissolved (Collins and Evans, 2002; Turner, 2006). Literature exploring expertise in decision making can be divided into two contrasting perspectives: firstly, 'expertise as epistemology', which is about classifying knowledges and then labelling people on the basis of whether they fit into such classifications (e.g. Turner, 2006; Collins and Evans, 2002; Collins and Weinel, 2011). The second approach is to view 'expertise as a social process' which emphasises expertise as conferred upon individuals (Gieryn, 1999; Jasanoff, 2003; Wynne, 2003). Viewing expertise as a social process focuses on power, because expertise concerns both 'what' is

going to count as relevant knowledge and subsequently 'who' then possesses such knowledge to inform policy debates within the public arena (Gieryn, 1999; Jasanoff, 2003; Eden et al., 2006). More relevant to this paper is the work of Nowotny et al. (2003) who argued that the issues that experts confront are characterised by overlaps and interlinkages that bind knowledge into local, social contexts. Expertise is thus "transgressive" in that it addresses issues that cannot be reduced to either the purely scientific or technical.

The process of creating practice involves the selective generation of further evidence. Evidence includes "all types of science and social science knowledge generated by a process of research and analysis, either within or without the policy making institution" (Juntti et al., 2009: p. 208). Jasanoff (2003) has raised numerous questions about what counts as relevant evidence with respect to a particular controversy and who possesses the right sort of knowledge to produce the evidence. Recognising expertise gleaned from a range of people thus becomes important, rather than relying on just one expert. Equally important is the mutual understanding between professionals with different bundles of expertise. This is closely related to the political culture of the decision making process and the power relations between those involved. Hence the rules, procedures and goals determine the appropriateness of a range of evidence sources, types and use, with the use of certain types of evidence masking both conflicts of interest as well as potential synergies (Juntti et al., 2009). IPA draws attention to the ways in which the processes of handling, moving and using data play a role in determining the implementation of policies.

At the simplest level knowledge brokers 'effectively construct a bridge between the research and policy communities' (Nutley et al., 2007: p. 63). Knowledge brokerage thus includes 'all the activity that links decision makers with researchers, facilitating their interaction so that they are better able to understand each other's goals and professional cultures, influence each other's work, forge new partnerships and promote the use of research-based evidence in decision making' (Lomas, 2007: p. 131). In this way knowledge brokers move knowledge around and make connections, but also produce a new type of knowledge; brokered knowledge (Meyer, 2010; Sheate and Partidario, 2010). Whilst knowledge brokers play a key role in bringing groups with different perspectives and expertise together, they do not have an explicit strategic role linked to delivering a desired outcome. Knowledge brokers and intermediaries have overlapping, yet slightly different parts to play in the implementation of management decisions.

Intermediaries also play a significant role in negotiating and policy making. Medd and Marvin (2008) identify a range of organisations that function as intermediaries linking actors and actor groups who fulfil an intermediary role. Intermediaries in their examples range through individual actors, organisations, networks and even programmes of work and focus on the relationship between the producers of science and its use as evidence to create policy. A key role of the intermediary which is not usually undertaken by the knowledge broker is the strategic vision and political manoeuvring that is undertaken following the presentation and interaction of different knowledges and evidence. It is this aspect, the creation of a working institution and the associated practices to deal with a particular environmental concern that we explore here. One research area where the roles and types of intermediaries have been explored is in business innovation. This work identified: mediator/arbitrator, sponsor/funds provider, filter/legitimator, technology broker and resource/management provider (Howells, 2006; Johnson, 2008; Klerkx and Leeuwis, 2009). However, the literature does not satisfactorily investigate how these roles play out at the organisational scale.

Drawing on the concepts introduced above we go on to explore the different facets of the contributions from a range of actors in their day to day workings managing the freshwater environment. We analyse the ways in which different people come together and how different forms of knowledge are woven into the evidence for decision making. In this way we use the

approach of interpretative policy analyses to focus on the meaning, expression and communication of management of the freshwater environment. By so doing we present a more detailed analysis of professional practice than has previously been reported.

3. The case study

The research which forms the case study was initiated by Louise Bracken's participation in the Esk Pearl Mussel and Salmon Recovery Project in her role as a fluvial geomorphologist. The River Esk is an upland river in Yorkshire in the north of England. Data for the paper were collected through participation within the committee and in the field and reflexive observation, coupled with analysis of the minutes of meetings and 21 semi-structured interviews which had been undertaken as part of a project on 'Angling in the Rural Environment'.³ The ethnographic work was supported by further in-depth interviews with three key individuals involved in the project. Written documents were analysed to produce a time line of events relevant to pearl mussel conservation in the River Esk. Discourse analysis was applied to written documents and transcripts of the interviews to identify key decisions, their timing, characteristics, the people involved and their motivations. The methodology employed was based upon a grounded theory approach in which the data themselves generated the concepts to be explored and provide an opportunity for testing the findings beyond this specific case study.

The freshwater pearl mussel is an aquatic bivalve mollusc and is considered to be an indicator, umbrella and flagship species (Geist, 2010). The mussel was widely distributed throughout Europe, Scandinavia and north-eastern North America, but has suffered serious decline and is threatened with extinction (Hastie et al., 2000). The freshwater pearl mussel is listed as 'endangered' by the International Union for the Conservation of Nature and Natural Resources (IUCN). Many English rivers now contain only scattered individuals, with no juvenile mussels recorded (Skinner et al., 2003). Salmonid fish play a key role in the lifecycle of the freshwater pearl mussel as a host for mussel larvae (Skinner et al., 2003). Population declines have been caused by factors such as pearl fishing, pollution, acidification, organic enrichment, siltation, river engineering, declining salmonid stocks and changing flood frequency and magnitude (Hastie et al., 2000). It is important to protect and support freshwater pearl mussel populations because a decline could have a negative impact on riverine ecosystem processes (Vaughn and Hakenkamp, 2001).

4. Creating the institutional context

A time line identifying the main actions and events is shown in Table 1. A number of government agencies are responsible for the freshwater environment in north Yorkshire: EA has statutory responsibilities for delivering the government's environmental policies; NE are responsible for conserving and enhancing the natural environment. The purpose of the National Park Authority (NPA) is to conserve and enhance the natural beauty, wildlife and cultural heritage of the North York Moors National Park. Both the NPA and NE can directly influence farming practices and land management of the Esk catchment through various schemes and grants. Within these bodies there are organisational divisions with differing areas of responsibility.

Table 1 – Timeline with key activities/events.

Date	Action/event
1995	English Nature (EN) (now Natural England (NE)), financially supported by the National Rivers Authority (now Environment Agency (EA)) commissioned a survey of the status of pearl mussels in the seven English rivers known to support pearl mussels, including the Yorkshire Esk. The survey forms part of the UK Government's response to meeting the Rio Biodiversity Challenge (Biodiversity: The UK Steering Group Report, 1995). 138 scattered mussels found (120 mm mean length).
1999	The EA commissioned a re-survey of the River Esk. 114 mussels found (none less than 30 years old).
2004	Following presentation of the Consultant's results EA contact with Durham University leads to Bracken being invited to explore the distribution of fine sediment transfer in the River Esk.
2005	Durham University research jointly funded by the EA and Durham University to refine the identification of sediment hotspots in the catchment.
2006	A survey by consultants of oxygen levels in the top bed sediments demonstrate they are capable of supporting juvenile pearl mussels. Esk Pearl Mussel and Salmon Recovery Project (EPMSRP) formed (meets quarterly).
2007	EPMSRP decided information was needed on water quality; Bracken asked to collect monthly samples at 9 sites. Re-survey of numbers by EA; 209 previously unknown mussels found. 29 mussels moved to Ark facility (11.1–15.6) cm. Funding for pearl mussel officer secured and interviews held in December 2007.
2008	Project officer employed on a 3 year basis.
2009	Fish checked for glochidia infection on gills; 4 fish checked at 3 sites: site 1:0, 2:2, 3:3 but only one or two glochidia on each fish (expect closer to 4000 when breeding successfully). Bracken asked to undertake more detailed exploration of water quality including flood sampling.

The EA have primary responsibility for conservation of the freshwater pearl mussel.⁵ One individual in the Agency, Ben, became particularly interested in the mussel and it was his efforts that led eventually to the formation of the Esk Pearl Mussel and Salmon Recovery Project (EPMSRP) in 2006. Ben has both certified, a degree in natural sciences, and experiential, 17 years in the EA, knowledge (Fazey et al., 2005, 2006; Collins and Evans, 2002). On the one hand Ben recognised that conservation had to be underpinned with formal science and he commissioned a mollusc specialist to survey the situation in the river and an academic fluvial geomorphologist to provide data on sediment transfer, which were thought to be limiting mussel recruitment and survival (knowledge brokering). On the other hand, he negotiated bringing together the key actors from different agencies with access to both power and resources who could affect the activities taken to protect

the mussel. His role was also that of an intermediary, creating a strategic network of relationships that could support the overall conservation objective.

The EPMSRP committee is composed of 12 people who represent 4 institutions with a range of expertise covering ecology, fluvial geomorphology, fisheries science and management, biodiversity, agricultural practices, environmental management and organisational procedures. In bringing this group together Ben drew on all five of the knowledges that [Nutley et al. \(2003\)](#) describe: know-about, know-what, knowhow, know-who and know-why. He knew about the problem and his previous experience, both instrumental and conceptual, informed him of what would work and that to put this into practice he would need to draw in other expertises. The first stage in setting up the committee was to go outside the organisation and identify the professional expertise required. One way of describing the role Ben played is as a 'street level bureaucrat', a special case intermediary who actively interprets policy and brings about change in response to the policy on the ground. This person takes the objectives of the policy and makes it workable in a specific context ([Juntti and Potter, 2002](#); [Proctor et al., in press](#)).

The two non-agency individuals who were drawn in to expand the scientific evidence available were Colin and Louise; Colin provided professional expertise on the animal and Louise on the habitat. Professionals have a particular expertise supported by resources and established within a socially recognised network. Professionals therefore have status and recognition and are legitimated through the roles that they play in particular contexts ([Jasanoff, 2003](#); [Gieryn, 1999](#)). Colin is a long established mollusc consultant with a PhD, a leading member of a learned society and clearly respected in his role by fellow professionals. Colin carried out the first survey in the Esk in 1995 and a more detailed re-survey in 1999. He did not attend meetings but was called on through site visits and subsequent reports with Ben acting as a knowledge broker.

Louise has a doctorate in fluvial geomorphology and more than fifteen years academic experience. Her expertise is recognised through her publications and membership of professional societies. For ten years she has had strong working relationships with the EA in the north of England. Louise brought the expertise associated with belonging to a university community; and, provided skilled, supervised labour to the study of the river through research students.

There is a significant difference in the relationship between the two non-agency individuals and the EPMSRP group. Colin's role was as a consultant under contract with a clearly defined service to deliver. The consultant's report was a stand-alone piece of information which was not able to enter into a dialogue with those reading it. Louise attended meetings, regularly updated findings and interacted with other members of the committee. Thus the institutional context within which knowledge was transmitted was quite different. Louise's expertise grew to include experiential learning as she considered her own field together with her increasing knowledge about the pearl mussel.

The committee acted as a nexus of power and resources. Ben helped the group of people to understand their common objectives. Ben encouraged full participation, promoted mutual understanding and cultivated shared responsibility, drawing upon people from different organisations to form strategic partnerships. In the process each organisation was able to achieve positive outcomes in terms of different but related targets.

In order for the committee to fulfil its objective, to conserve the freshwater pearl mussel, Ben needed to identify the particular departments and individuals within the different organisations who had the relevant expertise. The main agency stakeholders and the EA had a history of working well

together although this was not always achieved on the ground. Asked how he went about finding the individuals to work on a project committee Ben built upon his existing professional networks:

'I'd ring up the local [relevant organisation] team, the person I know there, . . . who would you recommend? . . . So its really all through contacts and then just exploring. So you'd be drilling down. . . it's about then trying to engage them in getting involved and seeing if they have got the time and enthusiasm about the project. . . there are no rules written down on that its very ad hoc. . . . it's all done on networks really and it's quite a small field conservation.'

At the first level he is accepting the judgement that these people are professionals, socially recognised holders of expertise, but at the next stage he uses his own expertise to judge their suitability for specific roles and to engage their interest and commitment (Turner, 2006). There is also a role for serendipity. Ben had been in the audience when Louise gave a presentation and he recognised that she had skills useful to the study of the pearl mussel.

One of the benefits of accessing a wider institutional environment is in gaining access to further resources. Resources can take a number of forms: staff time and money but also include the provision of an organisational basis to apply for funding and matched funding from external sources. Thus knowledge about 'who' and 'how' is also about additional funding streams. The wider institutional environment can mean going beyond the department bounds even within an agency. For example:

' . . . my key focus is pearl mussels, but because sedimentation affects the fisheries. . . there was a really good tie in there. . . we thought it would be better to tie in with fisheries, because we would have a better chance of getting funding from national [EA] pots, both from the national fisheries pot and from the biodiversity pot.' (Ben)

The negotiation about 'how' to put the plans into practice was not achievable without two of the agencies working together; the EA and NPA. The NPA's decision to contribute to the Project was based on the wider benefits that the scheme would bring to the freshwater environment. Initially the NPA felt the best approach would be to pool existing partner organisation staff resources to work towards the project whilst the EA believed a dedicated project officer post would produce a better outcome. The NPA later agreed and used some legacy money, along with a financial contribution from the EA, to support a bid for external funds to employ a dedicated project officer. The bid was successful and a project officer was initially employed for 3 years. The project officer put the 'know-how' into practice. Thus the very different knowledges were used together to support the overall aim.

In creating the committee, as an institution, Ben saw potential in opportunities with very different characteristics; he followed through on social networks within organisations, drew on the chance meeting with Louise and used the strategic objectives of organisations beyond his immediate concern to initiate mutually beneficial actions. He provides an example of the 'double dynamic' (Hajer, 2003) in practice at a local level and demonstrates how transgressive expertise is vital in implementing policy as proposed by Nowotny et al. (2003).

5. The enrolment of evidence in practice

In this section we explore in greater depth two key elements in determining the formation and implementation of management plans for the conservation of the freshwater pearl mussel. By exploring these processes we are uncovering the 'what' and 'how' of achieving meaning in practice.

This also makes clear that there were alternative routes not taken and the outcomes of the processes were not therefore inevitable.

How many pearl mussels are there in the River Esk?

The data on numbers are significant because they provide a baseline for measuring change and allow arguments to be made about the long term viability of the population in the river. Colin was commissioned as a part of the national study on the state of the freshwater pearl mussel in 1995 and for a local re-survey in 1999. Colin maps most closely on to [Turner's \(2006\)](#) type V expertise, that is, he is a paid expert but

'...the primary audience is not the public, but individuals with discretionary power, usually in bureaucracies. The legitimacy of the cognitive authority exercised by these individuals is not a matter, ordinarily at least, of direct public discussion. . .' (2006: p. 172)

The distinction between the cognitive authority and the discretionary power in the translation of the evidence is important because the data and associated recommendations are reported to the committee but the consultant does not play a role in translation or use. It is the consultant that is legitimated, rather than the report that he produced. The role of Ben as intermediary and knowledge broker is highly significant at this stage: he decided which elements of the report were acted upon. This selective use of evidence raises questions about the legitimacy for the claim that this is evidence based practice. Legitimacy does not just lie with the way in which the numbers are produced but also has to apply to the process of selecting information for framing the subsequent work on the river.

A second aspect is that the work was initiated by the commissioning body which framed the question, but the empirical data was constrained by limited funding. The count was limited to a sample of suitable habitats in the river. Mussels are counted by looking at the bed of the river in low flow through a 'glass based bucket'. The juveniles in particular are extremely hard to spot. Sampling was not random but purposive based upon where the consultant expected to find mussels according to: previous sightings, past experience, knowledge of preferred habitat, and the practicalities of seeing mussels embedded in coarse gravels and silt of the river bed – a use of both explicit and tacit knowledge. This process also incorporated some lay knowledges through chance meetings on the river whilst collecting data.

The number of mussels was a significant piece of evidence because it formed the baseline to drive action for conservation. The estimates of pearl mussels differ ([Table 1](#)) initially suggesting a declining population, but more recent data suggests uncertainty. In 2007 over 200 more mussels were found during a survey by an Agency employee asked to resurvey the river. She was recently trained and unrestricted in time and had more opportunity to use her local knowledge of the river catchment to identify additional sites. By early 2010 the Project Officer, a third person counting, found 508 mussels in total, some located much further upstream than expected. Thus even in what seems to be a straight forward piece of evidence, the number of mussels, there is a high degree of uncertainty.

A short hand has been adopted in communication of mussel numbers from the consultant's report. It is not made clear that the numbers refer to samples and simple statements are made that there are x pearl mussels in the River. The consultant makes the statement in his report that 'it is unlikely that pockets of individuals were overlooked', encouraging the numbers to be reported as total number in the Esk. Confidence in the professional expertise applied to counting the mussels meant that the numbers were taken as a true record. However, the implication is that the situation is much

worse than it may in fact be and issues of sampling and the degree of uncertainty around numbers are not communicated at the same time that the numbers of pearl mussels are presented.

There is agreement that the population is aging and no juveniles have been found: a key driver to the conservation effort. In light of the low numbers uncovered in the 1999 survey the consultant recommended that conservation measures could not be justified and was unable to suggest any positive action to arrest the decline in numbers. He did however suggest an annual survey to monitor decline. Yet Ben used his discretionary power to ignore the recommendation whilst using and communicating widely the estimated population of pearl mussels and the evidence of their decline. In fact it seems to have stimulated a reverse of the recommendations.

We asked Ben why he had taken this decision and he responded by email

'I chose to ignore [Colin's] advice because between the EA and the National Park we considered that the species was special and worth saving. We agreed that it would not be right to sit back and watch it die out and that we had to try something to save the species from local extinction, especially given the national scale of population decline. We felt that the River Esk was a small river and that as the mussels were only found within the upper most reaches (. . .) that only a short section of the catchment needed tackling in an attempt to try and recover the species fortunes. In addition the whole of the upper Esk falls within the NYMNP (North York Moors National Park) and we believed that through the National Park's land management teams we had a good chance of influencing landowners to begin tackling the wider land management issues that adversely affect the pearl mussel.'

The quote shows the way in which scale is used to support the argument for conservation action: the 'local extinction' in relation to national decline and the ability to manage the habitat of the mussel on this local scale engaging with the local partner. These are sound arguments for supporting his enthusiasm and interpretation of the consultant's report. Ben focused on the suggested relationship between the fine sediment and decline in pearl mussel numbers. As a result he commissioned further research, this time on sediment transfer in the river, which he then used to develop the knowledge and evidence base about pearl mussel habitat. Ben acted as an intermediary, building on his earlier role as a knowledge broker (Juntti et al., 2009). Furthermore, this is an active example of the use of power to shape the management pathway (Moss, 2009).

Is fine sediment the cause of decline?

The consultant argued that one of the causes of the decline was likely to be fine sediment. Factors detrimental to juvenile mussels are also detrimental to the incubation of salmon. The links between impacts of the sediment processes tie both animals, the salmon and the mussel, into the same argument – which has been useful politically in bringing funds together from different sources. However, it may place too high an emphasis on the role of sediment in the decline of the mussel.

This was the point at which Louise was invited to investigate the spatial and temporal distribution of fine sediment in the River Esk. She proposed a cheap and effective approach as an efficient use of limited resources. Two years' worth of data had been generated prior to the official start of the EPMSRP committee and these played a contributory role in the arguments for setting up the committee. Again, Ben was acting as an intermediary: putting the know-how into practice with a partnership agreement between the institutional interests. This can be viewed in two lights: on the one hand, he uses Louise's expertise which is legitimated by her professional status; and on the other hand it is a use of Louise's cognitive knowledge to push forward an argument about how things could be managed in the catchment.

The focus on evidence gathering moved from data on the mollusc to fine sediment transfer. As a professional expert Louise was treated rather differently to the consultant: she was not ‘translated’ or edited by the bureaucracy – she was present and delivered the results of her own expert practice directly. Just as the committee did not question the legitimacy of the mussel data they did not feel the need to validate or interrogate the sediment data. The data were not published for peer review at this point but were made available to fisheries and biodiversity officers within the EA and other institutions to develop their management plans to reduce sediment entering the river; a clear demonstration of the effectiveness of this direct communication which provided academic validation for the perspective already held by the agencies involved. As an officer of the NPA said at a public meeting about the freshwater pearl mussel:

“...there’s probably lots of different factors but the advice we’re given says sediment is a key thing”

Until this point there had been no systematic engagement with local knowledge about the pearl mussel. This underlines that Ben’s primary role was as an intermediary rather than a knowledge broker, since he selected whose expertise should contribute to decision making. Later conversations with local river users revealed a deep and complex understanding of the factors affecting the lifecycle of the pearl mussel:

“A lot of them are of the inclination that they think the silt has a lot to do with it. It may have a bearing, I’m quite sure on it, but when a lot of them were about 50–60 years ago, I would have thought there was still quite a lot of silt about then. But there certainly wasn’t the chemicals and slurry then. So okay they don’t like silt and silt has a negative effect on them, but I would have thought that the other pollutants were more likely to have a detrimental effect on the pearl mussel.”

A second, alternative narrative was suggested by a resident heavily engaged in a local wildlife group. This was that the high number of coal fired power stations located around the edge of the National Park affects the air and rain water quality, with a potential impact on the freshwater environment. Later research plans were broadened to accommodate a wider range of variables. Both Colin and Louise had identified nutrients and water quality as significant factors affecting the recruitment of the pearl mussel. However, the research remained focussed on siltation for financial reasons, it was not until this work had become established and more resources became available that investigations into water quality were initiated. Growth nutrients, especially phosphorus, are known to strongly adhere to soil particles, so addressing the siltation issue was also felt to partially address nutrient concerns raised by Colin.

6. Discussion

There is an overarching imperative to achieve good management of land and water to meet the requirements of the Water Framework Directive and the Habitats Directive. We have shown one way in which this policy imperative can be worked through in practice and analyse this in light of Yanow (1996) and Yanow’s (1996, 2009) calls for IPA. Although the methods used in our study do not allow us to look at the alternatives that could have been pursued there were many points, both implicit and explicit, where different choices could have been made. A number of implications arise from this investigation.

The first is the part of key individuals who play multiple roles in driving the project and oiling the machinery. As an intermediary Ben took up these multiple roles and used the body of research available to him in the ways described by Nutley; as instrumental, conceptual and for mobilizing support. Although the EA has a duty to conserve the freshwater pearl mussel in England and Wales it does not apply to any specific or nominated river. Ben’s enthusiasm was the driver for action on the

Esk which nationally had not previously been seen as a priority area for intervention. In creating a strong institutional context for action Ben was both a knowledge broker and intermediary in the commissioning and use of evidence to support management changes. The role of broker is important (Lomas, 2007; Meyer, 2010); the communication between expertises grounded in different disciplines is vital and sensitive and it would be unwise to make an unquestioned assumption that what one professional says is understood to mean the same thing by another (Bracken and Oughton, 2006). Yet, the role of intermediary was the dominant role played by Ben since he took strategic decisions about who to involve to implement environmental policy and was less focused on bringing the complete range of views together from which to initiate action. This finding is similar to the role of intermediaries highlighted by Juntti et al. (2009).

Ben's job is a complex expert role working at the boundary between evidence generation and professional practice. This job is supported by professional training but is enriched and strengthened by experience. In a climate of partnership working, matched-funding and buying in of consultants, the job is difficult to describe with a single title that covers such a complex skill set. The analysis of decisions presented demonstrates how Ben's expertise is transgressive, agreeing with Nowotny et al. (2003). The project may be extremely vulnerable to losing individuals who act as keystone to the network and, more generally, the organisational restructuring that characterises bureaucracies may cause widespread damage to individual projects if this key person is moved. However, the role of intermediary can be successfully developed and continued by the group taking responsibility rather than an individual.⁸ The establishment of the EPMSRP has created an organisational node in the network that functions as a successful intermediary.

The second implication concerns how the experience and history of both the individual and the organisation come together to handle and use knowledge and expertise (Jasanoff, 2003). The institutional environment implicitly prioritises and weights different knowledges in the management of a project. In our case study the 'know how to put into practice' and the 'know who to involve' were the most visible (Nutley et al., 2003). This made it possible to secure funding for a dedicated project officer, resulting in a considerable amount of activity in the catchment. The role of the intermediary was key to securing successful implementation. Implementation is less about securing all the relevant knowledge as takes place in brokerage, but about taking strategic decisions to get work done and mapping this onto regulatory and governance frameworks at multiple scales. The analysis presented adds detail to the roles of intermediaries identified by Howells Q4 (2006) and Johnson (2009).

The third implication relates to how institutions select and shape evidence in practice. As reported by Jasanoff (2003) the informed selective use of expertise and evidence may provide a number of ways of achieving a given objective and we see this in our analysis. The presence of uncertainty, both with respect to scientific findings and the social behaviour of human beings, means that management decisions should not be viewed as rigid or the only version of 'the truth'. There are multiple points where equally compelling choices are available. That is, there may be more than one narrative describing the route to achieving a particular outcome. We have shown how this process of selection and shaping has worked in the case of the EPMSRP; there was a desire for both quantitative and expert evidence, but this evidence was used selectively according to both individual and group decisions.

By focussing upon the different knowledges, their selection, legitimisation and use we have been able to gain deeper insights into the day to day management and governance of biodiversity conservation using the example of the River Esk. In this case the skilful balancing of different knowledges has brought about changes in land management to improve the environment for the pearl mussel and biodiversity more widely. It is too early to tell whether these changes will ultimately increase the

population of pearl mussels in the River Esk although the work by the EPMSRP to encourage changed land management to reduce silt and improve water quality continues and will assist in meeting WFD targets.

7. Conclusions

Our paper reports an in-depth study of the double dynamic, of simultaneously forming and implementing rules of management practice, at the local level (Hajer, 2003). The novelty of this paper lies in its focus on those who are responsible for implementing, rather than designing, policy; key groups identified in IPA (Yanow, 1996; Yanow and Tsoukas, 2009). Much international and national legislation depends on this local level implementation of policy. Our research highlights the complex and overlapping role of expertise and evidence in professional practice that remains poorly understood.

The significance of key individuals is well recognised in environmental management (Lomas, 2007; Meyer, 2010). Our analysis demonstrates that what matters is the strategic intermediary role of professionals in making something happen on the ground, especially in securing resources. This is subtly different from knowledge brokerage in that professionals work towards securing a route of action. Both individuals and groups can act as intermediaries. In our case study the creation of the committee filled an institutional void (Hajer, 2003) with respect to a particular environmental objective. It could have proved to be a temporary measure dependent upon key individuals as a driving force. However, its relative success has ensured its continued existence and work despite changes in key personnel. The longevity of the committee supports both social and technical learning and ensures more effective and efficient decision making. Both the individuals and the committee employ transgressive expertise (Nowotny et al., 2003) in making decisions about implementation. Our research underlines how much strategy is employed by professionals when implementing policy and this should be included in analysing social process of decision making alongside the 'who' and the 'what' previously highlighted by Gieryn (1999) and Jasanoff (2003).

Data used as evidence are often uncertain and additional data may not reduce the level of uncertainty. In these circumstances the role of the professional is to draw on expertise, both formal and tacit, to interpret and judge in relation to decision making. Evidence can be acted upon or rejected. Our research demonstrates that in a group situation the quality of the evidence is assumed adequate once subject to diverse professional scrutiny. The expert becomes legitimated rather than the evidence itself. Grouping of professionals thus provides confidence to act quickly – an important feature of day-to-day environmental management. The expectation from Campbell et al. (2011) that policy makers should be using the 'best available evidence' from research when making decisions does not recognise key issues reported in this paper around the uncertainty in data, communicating the way in which the evidence was generated, or the social processes at play in selecting a course of implementation. We propose that evidence is messy and that whilst the evidence, ideas, arguments and framing all matter in making decisions (Jasanoff, 2003; Owens, 2010), professionals make strategic choices about how to implement policy depending on the objectives of a particular project. In this way they decide whether evidence is 'good enough' to act upon and may choose to ignore expert advice if it does not help meet project objectives.

Innovative behaviour that creates new structures and practices, new institutions, is becoming central to delivering good management of land, water and biodiversity. The complexity of problems, breadth and diversity of evidence, speed of legislative change and complex governance structures mean new groupings of expertise have an important role and that investment of time and resource can have pay-offs for meeting multiple objectives in a range of situations. New institutional practices are developed to 'get things done'; these will be unique to each situation: the environmental issue,

the policy context, the physical location, the relevant organisations, the individuals involved and how they are brought together at a particular point in time. However, there is a general lesson to be learned which is that those individuals participating in decision making of this nature have multiple histories, roles and motivations which enables innovation in the creation of meaning within environmental management. IPA provides a framework for further analyses to assist in identifying better practice.

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Bracken, L.J., Oughton, E.A., 2006. 'What do you mean?' The importance of language in developing interdisciplinary research. *Transactions of the Institute of British Geographers* 31, 371–382.

Callon, M., 1999. The role of lay people in the production and dissemination of scientific knowledge. *Science, Technology and Human Values* 4, 81–94.

Campbell, D., Braedon, D., Moore, G., Frew, D., 2011. Evidence check: knowledge brokering to commission research reviews on policy. *Evidence and Policy* 7, 97–107.

Collins, H.M., Evans, R., 2002. The third wave of science studies: studies of expertise and experience. *Social Studies of Science* 32, 235–293.

Collins, H.M., Weinel, M., 2011. Transmuted expertise: how technical non-experts can assess experts and expertise. *Argumentation* 25, 401–413.

Eden, S., Donaldson, A., Walker, G., 2006. Green groups and grey areas: scientific boundary work, NGOs and the changing nature of environmental knowledge. *Environment and Planning A* 38, 1061–1076.

Fazey, I.J., Fazey, A., Fazey, D.M.A., 2005. Learning more effectively from experience. *Ecology and Society* 10 (2).

Fazey, I., Proust, K., Newell, B., Johnson, B., Fazey, J.A., 2006. Eliciting the implicit knowledge and perceptions of onground conservation managers of the Macquarie Marshes. *Ecology and Society* 11 (1), 25.

Fish, R.D., Ioris, A.A.R., Watson, N.M., 2010. Integrating water and agricultural management: collaborative governance for a complex policy problem. *Science of the Total Environment* 408, 5623–5630.

Geist, J., 2010. Strategies for the conservation of endangered freshwater pearl mussels (*Margaritifera margaritifera* L.): a synthesis of conservation genetics and ecology. *Hydrobiologia* 644 (1), 69–88.

Gieryn, T., 1999. *Cultural Boundaries of Science: Credibility on the Line*. University of Chicago Press, Chicago.

- Hastie, L.C., Boon, P.J., Young, M.R., 2000. Physical microhabitat requirements of freshwater pearl mussels, *Margaritifera margaritifera* (L.). *Hydrobiologia* 429, 59–71.
- Hajer, M., 2003. Policy without polity? Policy analysis and the institutional void. *Policy Sciences* 36, 175–195.
- Howells, J., 2006. Intermediation and the role of intermediaries in innovation. *Research Policy* 35, 715–728.
- Jasanoff, S., 2003. Breaking the waves in science studies: comment on H.M. Collins and Robert Evans, “The Third Wave of science studies” *Social Studies of Science* 33 (3), 389–400.
- Johnson, W.H.A., 2008. Roles, resources and benefits of intermediate organizations supporting triple helix collaborative R&D: the case of the Precarn. *Technovation* 28 (8), 495–505.
- Juntti, M., Potter, C., 2002. Interpreting and re-interpreting agri-environmental policy: communication, trust and knowledge in the implementation process. *Sociologia Ruralis* 42 (3), 216–232.
- Juntti, M., Russel, D., Turnpenny, J., 2009. Evidence, politics and power in public policy for the environment. *Environmental Science & Policy* 12 (3), 207–215.
- Klerkx, L., Leeuwis, C., 2009. Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector. *Technological Forecasting and Social Change* 76, 849–860.
- Lidskog, R., 2008. Scientised citizens and democratise science. Re-assessing the expert-lay divide. *Journal of Risk Research* 11, 69–86.
- Lomas, J., 2007. The in-between world of knowledge brokering. *British Medical Journal* 334, 129–132.
- Medd, W., Marvin, S., 2008. Making water work: intermediating between regional strategy and local practice. *Environment and Planning D: Society and Space* 26, 280–299.
- Meyer, M., 2010. The risk of the knowledge broker. *Science Communication* 32, 118–127.
- Moss, T., 2009. Intermediaries and the governance of sociotechnical networks in transition. *Environment and Planning A* 41 (6), 1480–1495.
- Nowotny, H., Scott, P., Gibbons, M., 2001. *Re-thinking Science: Knowledge and the Public in an Age of Uncertainty*. Polity Press, London.
- Nowotny, H., Scott, P., Gibbons, M., 2003. ‘Mode 2’ revisited: the new production of knowledge – Introduction. *Minerva* 41 (3), 179–194.
- Nutley, S., Walter, I., Davies, H.T.O., 2003. From knowing to doing: a framework for understanding the evidence-intopractice agenda. *Evaluation* 9 (2), 125–148.
- Nutley, S., Walter, I., Davies, H.T.O., 2007. *Using Evidence: How Research can Inform Public Services*. Policy Press, Bristol.

Owens, S., 2010. Learning across levels of governance: expert advice and the adoption of carbon dioxide emissions reduction targets in the UK. *Global Environmental Change* 20, 394–401.

Petts, J., 2007. Learning about learning: lessons from public engagement and deliberation on urban river restoration. *The Geographical Journal* 173, 300–3011.

Proctor, A., Q5 Donaldson, A., Phillipson, J., Lowe, P. Field expertise in rural land management. *Environment and Planning A*, in press.

Sheate, W.R., Partidario, M.R., 2010. Strategic approaches and assessment techniques – potential for knowledge brokerage towards sustainability. *Environmental Impact Assessment Review* 30, 278–288.

Skinner, A., Young, M., Hastie, L., 2003. Ecology of the Freshwater Pearl Mussel. *Conserving Natura 2000 Rivers Ecology Series No. 2*, English Nature, Peterborough.

Turner, S., 2006. What is the problem with experts? In: Selinger, E., Crease, R.P. (Eds.), *The Philosophy of Expertise*. Columbia University Press, New York, pp. 159–186.

Vaughn, C.C., Hakenkamp, C.C., 2001. The functional role of burrowing bivalves in freshwater ecosystems. *Freshwater Biology* 46, 1431–1446.

Wynne, B., 2003. Seasick on the Third Wave? Subverting the hegemony of propositionalism: response to Collins and Evans (2002). *Social Studies of Science* 33, 401–417.

Yanow, D., 1996. *How Does a Policy Mean?* Georgetown University Press, Washington, DC.

Yanow, D., 2000. *Conducting Interpretative Policy Analysis*. Sage, Newbury Park.

Yanow, D., Tsoukas, H., 2009. What is reflection in action? A phenomenological account. *Journal of Management Studies* 46, 1339–1364.